



The Colorado **CONSERVATOR**

The Nonpoint Source Newsletter of Colorado
"Voluntary Solutions to Water Pollution"



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SPECIAL ISSUE

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Marshall Wetlands is an innovative
reclamation by Western Mobile Inc. on
200 acres of surfaced mined lands in
Boulder County.

Wetlands Created from Surface Mined Site

Wetlands Created from Surface-Mined Site

by Doug Gladwin, Sterna Fuscata, Inc.

Western Mobile Inc., a Redland Group aggregate mining company, recently completed an ecologically innovative reclamation on 200 acres of surface-mined lands in Boulder County. The Company's Marshall Wetlands project utilized a unique approach to wetland creation and water conservation which is dramatically reducing loss of valuable ground and surface water and at the same time creating habitats for native plants and animals.

Dallas "Whitney" Glasser, project coordinator, says, "Our wetlands project was born out of necessity. We needed to dispose of washed fines and this was the least expensive way to do it. As we pumped the materials into our ponds, we created shallow peninsulas, where wetland plants could thrive, with water depths of zero to two feet. It was simple and manageable. And the ducks, geese and heron love it."

Rather than selecting the traditional reclamation method of allowing mined areas to simply fill with ground water (at an evaporative loss of approximately four feet/acre/year in this semi-arid environment), Western Mobile in 1989 initiated an ecologically-innovative reclamation procedure.

The reclamation process at the Marshall site, which (other than ongoing ecological research) will conclude during 1997, involved creation of a series of seven hydrologically-connected settling

lakes used to settle out "wash fines" from the site's aggregate processing plant. The project exceeds full compliance with all local, state, and federal mined-land reclamation and other environmental regulations and best management practices. The fines were introduced into the lake basins, (sand and gravel mining excavations) in a slurry, with one lake being filled with this material each year. The company began filling the southernmost (and highest elevation) basin with wash fines in 1989, with the process continuing to an adjacent, downslope lake each year. The lowest elevation (seventh) basin is currently being filled. Water is cycled through the wetland complex for purification and then returned to the aggregate processing plant for re-use.

Once filled with the washed fines, the lake basins became ideal hydrologic and substrate conditions for establishment of highly-valued riparian wetland plants through natural influx of seeds (i.e., nothing needed to be planted). Through simple management of slurry distribution and water level in each of the settling basins, and by designing them to emulate the non-symmetrical wetland shapes commonly found in nature, ecologically-diverse habitats have been created for native plant and animal life. Each of the seven wetlands exhibits a slightly different community of plants and animals.

The Marshall Wetlands Project demonstrates, in a cost-effective manner, that large amounts of ground and surface

water can be conserved during the aggregate mining, processing, and reclamation process while at the same time creating highly valuable wildlife habitats. By doing so and widely publicizing the project results, Western Mobile hopes to encourage other mining companies and land managers on a regional, national, and international basis to implement similar innovative procedures. If implemented at these higher geographic levels by other land managers and mining companies, it is estimated that the innovative approach to materials processing and mined land reclamation pioneered by Western Mobile at its Marshall site could save countless thousands of acre-feet of water each year while at the same time creating invaluable wetland habitats.

Western Mobile Inc. is a leading source for aggregate, asphalt, and concrete products in the Rocky Mountain west. The company has grown steadily since its beginning in 1921, achieving a reputation for superior quality products and service through sustained on-site performance. All of this has been achieved in harmony with an active and conscientious respect for conservation of water, wildlife habitat, and other natural resources, stimulating the company to aggressively return mined-lands to "pre-settlement" environmental quality. Tours and site investigations may be arranged by calling Western Mobile at 303-494-5133.

Marshall Wetlands is an innovative reclamation by Western Mobile Inc. on 200 acres of surfaced mined lands in Boulder County.

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Well-A-Syst... Helping Rural Residents Maintain "Well" Water Quality

By Petra Barnes and Percy Ariola

The Colorado Well Assessment System (Well-A-Syst) project was developed through the Natural Resources Conservation Service's (NRCS) AmeriCorps program and the San Juan Resource Conservation and Development (RC&D) office to evaluate the environmental factors associated with the use of private domestic wells. This Project is a spin-off of the National Farmstead Assessment System/Home Assessment System (Farm-A-Syst/Home-A-Syst) program operating in several states in the midwest. "It was important for Colorado to have a program that addressed domestic well water quality," says Percy Ariola, AmeriCorps member, San Juan Colorado. "Coloradans who live in rural areas rely on private wells for drinking water and there are limited regulations regarding the quality of well water." NRCS AmeriCorps members began development of the project in early 1996. The program is regarded as an non-regulatory water quality initiative aimed at educating rural residents of the potential pollution sources that can impair water supplies. "We developed the project with input from various state and federal organizations and agencies", said William Lyon, AmeriCorps member, San Juan Colorado. "We'll also receive assistance from the U. S. Department of Agriculture, the Colorado Department of Public Health and

Mason's Receive Conservation Award

By Buddy Wilson, SLV Coordinator



Harriett and James Mason in front of windbreak they planted on their farm near Mosca.

Below the towering Sangre de Cristo mountains of southern Colorado, Jim and Harriett Mason have combined common sense and conservation to create a successful farm and ranch enterprise on the highly erodible lands of the north central San Luis Valley. Their operation located near Mosca, Colorado, is a model of innovation and alternative practices that have proven successful in the harsh environment of the area. Because of their efforts they have been recognized as the Outstanding Conservationist for the Colorado Chapter of the Soil and Water Conservation Society.

Harriett's father, Harry Stahl farmed

membership still hangs on a gate on the property. "My Dad always practiced soil conservation," Harriett continued, "His philosophy was to farm intensively, not extensively. We've carried that idea over into our current operation. We may not be huge but we strive to make the quality of our product first rate!"

One of the products that makes the operation a success is the organic potatoes that are produced. Over the past few years there has been a tremendous increase in demand for this tasty and wholesome commodity. The potatoes are combined in a rotation with alfalfa and rye. The rye is planted after the potato harvest to prevent wind erosion the fol-

lowing sources Conservation Service (NRCS) have been installed on the property. Pasture varieties recommended by the NRCS are also being successfully grown.

Livestock are utilized to successfully control weeds such as Tall Whitetop. This weed has become a major problem for landusers in the San Luis Valley. The corners of the farm's center pivots are cordoned off with electric fences and are used to pasture the operations beef herd. The Masons market their animals through the newly formed Rancher's Choice Cooperative. The Cooperative supplies Kosher meat to specialty markets across the United States.

Jim and Harriett Mason have planted several windbreaks. Not only to protect farmsteads and cropland, but to increase the amount of food, cover and water available for wildlife. Over 1.3 acres of windbreaks were planted in 1995 alone. Drip irrigation systems are employed to irrigate the shrubs and trees, some of which use water that has to be piped over a quarter of a mile to reach the windbreak.

As far as the future goes Jim and Harriett both expressed concern about landowners taking care of their soil. With large corporations coming in and buying up acreages the health and welfare of the family farm remains in jeopardy. As long as models of stewardship like the Masons live and work on the land, a bright future for the conservation of our natural resources is assured.

Costilla County More Weather Wise Now

By Ron Rigganbach,
Soil Conservationist, SLV-WQDP

The weather in the San Luis Valley is a very unpredictable thing as anyone knows who's lived here awhile. Growing

ments of the potential pollution sources that can impair water supplies. "We developed the project with input from various state and federal organizations and agencies", said William Lyon, Ameri-corps member, San Juan Colorado. "We'll also receive assistance from the U. S. Department of Agriculture, the Colorado Department of Public Health and Environment, and the CSU Cooperative Extension in the implementation process."

In assessing potential pollution risks, the project supports voluntary pollution prevention and is comprised of nine fact-sheets. They provide information on issues including management of rural wells, household wastewater systems, livestock operations, recycling of agricultural chemicals and fuels, and disposal of hazardous waste materials.

For more information about the Colorado Well-A-Syst Project, please contact Percy Ariola or William Lyons at (970) 259-3287.

novation and alternative practices that have proven successful in the harsh environment of the area. Because of their efforts they have been recognized as the Outstanding Conservationist for the Colorado Chapter of the Soil and Water Conservation Society.

Harriett's father, Harry Stahl farmed the land now owned by the Masons. Harriett, recalls driving a tractor when she was just big enough to stand on the clutch and make it go down. "I loved to work on the farm - and I still do" she stated. Jim, a native of Colorado's Arkansas Valley, met Harriett while attending Adams State College in Alamosa. They were married in 1970. He started teaching in 1971 in Center, Colorado and in 1972 he was hired by the Moffat School System and has taught High School Science there ever since.

In 1970, the couple started farming with Harriett's father and took over the management of the farm in 1978. Harry Stahl was one of the original cooperators with the Mosca-Hooper Soil Conservation District and a sign proclaiming his

One of the products that makes the operation a success is the organic potatoes that are produced. Over the past few years there has been a tremendous increase in demand for this tasty and wholesome commodity. The potatoes are combined in a rotation with alfalfa and rye. The rye is planted after the potato harvest to prevent wind erosion the following spring. After the rye is up it is pastured and then the remaining residues are mulched into the soil before the potatoes are planted the following spring. After the second year of potatoes with winter rye for pasture, alfalfa is planted. However this year the rye will be harvested as grain and will be sold on the organic market to a company in Texas. Stubble left after harvest remains on the soil surface to prevent wind erosion in the spring. Some of the rye straw will be baled and stacked on top of the alfalfa hay bales, to protect them from the weather.

"The six years of alfalfa provides the nitrogen for our potato and rye crops," Jim stated. "We fertilize the alfalfa heavily with phosphorous the first three years. We don't use any non-organic fertilizer the last three years to maintain our certified organic status." Soil tests determine crop needs and if extra nutrients are required, chicken manure is spread on the cropland as needed. Jim and Harriett neither use pesticides nor herbicides as the farm is certified organic. Economically harmful infestations of pests and weeds are controlled using cultural and/or mechanical methods.

Alternative marketing and cropping sequences are not the only innovative practices that are being used on the Masons' farm. Center pivot sprinkler irrigation plays a major part in the efficiency of the operation. The latest in Low Drift Nozzles are employed to enhance water conservation and headgates, pipelines and ditches designed by the Natural Re-

More Weather Wise Now

By Ron Riggbach,
Soil Conservationist, SLV-WQDP

The weather in the San Luis Valley is a very unpredictable thing as anyone knows who's lived here awhile. Growing crops can be a challenge each year, always being at the whim of mother nature.

One major factor in making decisions such as irrigation scheduling, is the use of weather stations to calculate evapotranspiration.

There are only a couple of weather stations in the area and the weather can vary widely across the Valley. For example, when it is raining on one producer's field, you can probably drive a few minutes and find another where the sun is shining. Because of this, having a weather station near your field is important.

For this reason, Costilla Soil Conservation District sponsored the installation of a weather station in the northern part of Costilla county. Weather information is now available for an area that previously was not covered by other stations in the valley.

The Costilla station will also be added to the stations whose information will soon be available on the COAGMET system supported by Colorado State University and available on the internet.

The Costilla weather station is a good example of how individuals and groups working together can accomplish a project that is almost impossible to do alone.



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Conservation Tillage Increases in Colorado

By Petra Barnes

Colorado saw a significant increase in crops planted using conservation tillage methods in 1996. According to the National Crop Residue Management Survey, "Over the past ten years, conservation tillage systems have experienced greater growth in the U. S." Acreages planted in Colorado using conservation tillage methods increased from 22% or 1.3 million in 1995 to approximately 27% or 1.5 million in 1996.

One purpose of conservation tillage planting methods is to decrease soil erosion caused by wind and water. Conservation tillage practices that assist in the prevention of soil erosion, due to water, include any tillage or planting system that covers 30 percent or more of the soil surface with crop residue after planting. Practices planned to control wind erosion maintain at least 1,000 pounds per acre of flat, small grain residue equivalent on the surface throughout the critical wind erosion period. These methods also measure soil organic matter, improve tilth, improve the water and nutrient cycle and generally enhance crop production.

"It's difficult to track the reasons for the increase in these methods," says Travis James, Former USDA NRCS State Agronomist, Lakewood. "Reports are released on a national, regional, and statewide level. To accurately pinpoint rationale for increases in conservation tillage systems, specialists would need information on a county by county basis." James goes on to say, "County by county results are available, however, they're tremendously time consuming to analyze. Therefore, we concentrate on the statewide level. If the increase occurred in southeastern Colorado, we may at-

river float trip, a study of wildfire dangers and prevention, and an optional hike down the Serpent Trail through the Colorado National Monument.

The partnership sponsoring the Workshop includes the Colorado Association of Soil Conservation Districts, Mesa Soil Conservation District, Colorado State Soil Conservation Board, Colorado Department of Education, Colorado State Forest Service, Colorado Division of Wildlife, and the Natural Resources Conservation Service.

Other resource people for the Workshop come from the Bureau of Land Management, Bureau of Reclamation, Colorado Water Conservation Board, U.S. Forest Service, National Park Service, City of Grand Junction Utilities Department, classroom teachers, and several private individuals. This is quite a partnership!

The workshop filled quickly this year with teachers from throughout the state attending. If you're interested in next year's workshop call CASCD to get on the mailing list.

1997 CASCD Youth Conservation Workshop

By John S. Berst, CSSCB

The Colorado Association of Soil Conservation Districts (CASCD) will sponsor a Youth Conservation Workshop this year. This workshop, for youth **between the ages of 14 and 19**, will be held at the Rocky Mountain Camp near Divide, CO. It will **start at 3:00 p.m. on July 6th** and **will end at 9:00 a.m. on July 12th**. The **fee is \$195.00** per participant. This includes all costs except transportation to and from the camp. Transportation is the

1997 National Western Stock Show!



Every year Colorado hosts the National Western Stock Show in January. Every year the 2 week event is a success not only for Colorado but also for NRCS and other partnering organizations. The Stock Show provides the perfect conservation education opportunity for adults and kids and we take full advantage of it. The Jefferson Soil Conservation District lead the sponsoring efforts in this year's conservation education activities.

The image used for the National Association of Conservation Districts (NACD) Backyard Stewardship cam-

paign was also used to convey this year's Stock Show booth theme, "Backyard Conservation - Caring & Sharing". In addition to the display, handouts were developed outlining the importance of knowing your soil, composting, and xeriscaping. Passers by were also entertained by our life size worm (a costume), two womerys, a compost bin, and much more.

A great time was had by all while learning about good conservation practices applicable in their own backyards.

Local Conservation Partnerships Formed

By Robert Zebroski, CSSCB

Soil conservation districts are providing leadership in Colorado's capacity building efforts. Capacity building is simply being responsible for developing conservation plans for all the natural resources within their particular jurisdiction. Other special purpose districts and agencies have a key responsibility for a

John Freziers, President of CASCD says, "In a nutshell, it asks districts to take the lead in planning, coordinating and carrying out all conservation programs at the local level—not just those provided by USDA, but those of other federal, state and local agencies and organizations."

leased on a national, regional, and statewide level. To accurately pinpoint rationale for increases in conservation tillage systems, specialists would need information on a county by county basis." James goes on to say, "County by county results are available, however, they're tremendously time consuming to analyze. Therefore, we concentrate on the statewide level. If the increase occurred in southeastern Colorado, we may attribute it to the recent drought that destroyed thousands of acres of wheat."

The increase in conservation tillage crops planted in 1996 were: corn up from 395,000 acres in 1995 to 456,000 acres in 1996, winter wheat which increased by 46,000 acres from 1995 to 1996 and grain sorghum which has the biggest increase of 22,000 in 1995, to 109,000 in 1996.

Conservation Viewpoint

By Daniel O. Parker Director, Colorado State Soil Conservation Board

The conservation of natural resources is moving in exciting directions. With the emphasis placed on partnerships and locally-led conservation, individual landowners are assured of many opportunities for input and ideas. However, each of us has to respond by participating.

Several projects are underway utilizing this new philosophy. The Alamosa River Project, the North Fork of the Gunnison-River Project and the three-state High Plains Project between Colorado, Kansas and Nebraska are cases in point.

Another illustration of partnerships is the Eco Rico Conservation Teachers' Workshop, holding its fifteenth session July 22-25, 1997, at the Howard Johnson Motel in Grand Junction, Colorado. The theme "From River To Rim" will take us from the Colorado River Life Zone to the Sub-Alpine Life Zone and will include a

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Goals of the workshop are to teach youth natural resource stewardship and prepare them for leadership roles in natural resource conservation. The participants will learn techniques for applying conservation practices in their own environments.

The curriculum is divided into four main categories: 1) Soil and Water; 2) Range; 3) Wildlife; and, 4) Forestry. Instructors at the workshop are working professionals in their disciplines.

Students will be given an overview of how all areas of the natural world interrelate. Participants will form integrated groups to inventory and evaluate a specific area of the camp and develop a set of resource management alternatives for the camp staff. Field classes with "hands-on" activities are held during the day. Evening activities will include an educational and enjoyable "Mountain Man" presentation, a "Star-Walk", and a snack bar.

Recreation is an important part of the workshop. A "challenge course" is available along with horseshoes, volleyball, basketball, softball, Ping-Pong, cards, and a "fun run".

Partial scholarships may be available from local soil conservation districts or other entities. More information may be obtained from the CASCD office at (303) 232-6242 or from the State Soil Conservation Board at (303) 866-3351.

Partnerships Formed

By Robert Zebroski, CSSCB

Soil conservation districts are providing leadership in Colorado's capacity building efforts. Capacity building is simply being responsible for developing conservation plans for all the natural resources within their particular jurisdiction. Other special purpose districts and agencies have a key responsibility for a certain part of the natural resources. To ensure the top quality of these natural resource plans, the soil conservation districts have to rely on the cooperation of many other partners including the land owners and concerned citizens.

Twelve training sessions have been scheduled throughout the State to equip the local soil conservation districts in the formation of these crucial partnerships. The objective of the training sessions is outline the procedure to identify the natural resource concerns of each county and set priorities within the concerns so identified. After this step, the local conservation partnership will seek funding for the top concerns and in many cases, this will be from other than the traditional sources commonly used.

John Frezieres, President of CASCD says, "In a nutshell, it asks districts to take the lead in planning, coordinating and carrying out all conservation programs at the local level—not just those provided by USDA, but those of other federal, state and local agencies and organizations."

In the past, government programs dictated the type of conservation program delivered to the landowners at the local level. Now the new emphasis is to have the local people identify what is needed and select the different federal, state and county programs and funding to fit the local natural resource program priorities.

As the local conservation partnership assesses the natural resource concerns, it is hopeful that water quality projects will be developed and applications for Section 319 funds of the Clean Water Act will be submitted to the Nonpoint Source Program for consideration. A successful project is dependent on a broad base of support and this could be best achieved through the local conservation partnership.

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Mill Tailings Reclamation Improves Fish Populations in Chalk Creek

By Bruce Stover, Colorado Div. of Minerals and Geology

The Chalk Creek Non-Point Source Project near St. Elmo, Colorado has been successful in improving water quality below the historic Mary Murphy Mine. Tests by the Colorado Division of Wildlife (DOW) show improvements to fish populations since completion of the tailings reclamation. Barb Horn, aquatic biologist with DOW, reports that more fish and more age classes are now present further upstream (below the mine site) than prior to reclamation.

The mill tailings consolidation project was executed at the historic Mary Murphy Mine and Mill complex in 1991 by the Colorado Division of Minerals and Geology (DMG) under contract with the Colorado Department of Health, Water Quality Control Division, using EPA 319 funds. The project involved consolidation and capping of metal laden mill tailings in order to prevent erosion and deposition of these toxic materials to the stream. The project also involved draining the Golf Tunnel of the Mary Murphy Mine, to stabilize the tunnel portal, and relieve the potentially hazardous flooded mine pool. An area of damaged wetlands was also reclaimed.

Metal levels in Chalk Creek are now only seasonally "marginal", suggesting that further more expensive and complex reclamation may not be cost effective or warranted, given the "fairly decent to good fishery" presently existing downstream from the historic mining site.

Mary Murphy Mine An Ideal Field Research Site

Another major benefit of work conducted at the Mary Murphy Mine is that the site has been recognized as an ideal research setting for developing and refin-

tem at the site. Valuable geochemical studies have been completed by Colorado School of Mines researchers which have helped to model metals-groundwater chemical interactions.

USGS Demonstrates Stream Tracing Technique

In cooperation with EPA Region VIII and DMG, the US Geological Survey conducted a stream tracer study in October of 1995 on a 600 meter segment of Chalk Creek from above the Golf Tunnel, to below the consolidated tailings area. Using detailed flow data coupled with in-stream ionic tracer concentrations, a section of creek beginning near the reconstructed wetlands was identified as the site of ground water inflows having elevated levels of zinc. These inflows were further partitioned to indicate 47% was "clean" inflow from the west bank, while the remaining 53% had elevated zinc levels coming from the east bank near the consolidated tailings pile and wetlands. Eighty percent of the identified zinc loading occurred in a 100 meter segment near the wetlands at the base of the consolidated pile.

The success of this technique for precisely delineating the location and magnitude of contaminated groundwater inflows to Chalk Creek resulted in its use at two other metals-contaminated streams in Colorado during 1996.

Ground Water Dye Tracing

In 1995, DMG applied to EPA and received a Headwaters Grant to demonstrate a dye tracer technique at the Mary Murphy Mine. The design goals of this project were:

- 1) To complete characterization of the



Volunteers for Outdoor Colorado and Trout Unlimited provided labor for replanting and restoring wetlands below the tailings site.

to carry out intensive water sample collections.

The demonstration study was a great success. All three dyes introduced into the mountain/mine-pool system, (including one injected at the top of the mountain in a 200 foot deep core hole above the mined out slope complex), have been recovered in previously drilled monitoring wells, springs, and Chalk Creek itself.

Interestingly, dye injected at the top of the mountain turned up two months later in groundwater in the area of the wetlands, near the inflow zone previously identified by the USGS stream study. This identified pathway appears to correspond with a deep seated, relatively slow-flow fracture system which appears to have elevated zinc concentrations associated with flow through the upper mine workings.

A second shallow, open-fracture flow, very fast moving ground water system beneath the consolidated tailings pile was also identified, and is suspected of being a flow path for metals leaching from the

consolidated pile. This source corresponds well with the zone of inflows indicated by the instream tracer study completed by the USGS.

Dye tracing sampling will continue through the fall and winter of 1996-97, as the data is analyzed and the hydrologic understanding of the site is further refined. The final report of investigation is due this spring, and will serve as a model for using this technique at many other hardrock mine sites in the Rocky Mountain west.

Future Plans

Based on the good fish and macroinvertebrate populations currently present in Chalk Creek, there are not immediate plans for further remediation projects. Techniques developed at the Mary Murphy Mine could have wide application to many of the hundreds of more problematic hardrock mine drainage sites in the Rocky Mountain west.

warranted, given the "fairly decent to good fishery" presently existing downstream from the historic mining site.

Mary Murphy Mine An Ideal Field Research Site

Another major benefit of work conducted at the Mary Murphy Mine is that the site has been recognized as an ideal research setting for developing and refining hardrock-mine hydrologic characterization techniques. DMG has been acting as site coordinator in support of the ongoing research activities at the site. Several important studies have been completed, which resulted in new groundwater investigation techniques. These include detailed examination of the Golf Tunnel discharge, and identification of the "unknown loading source".

Since 1990, monitoring work has continued at the site, both to track results of the reclamation of the tailings, and to develop a better understanding of the metals loading associated with the Golf Tunnel drainage. It was found that an 85% reduction in dissolved zinc was occurring inside the Golf Tunnel after the flooded pool was drained off. This finding sparked efforts to better understand the geochemistry and geohydrology of the mine-pool and bedrock groundwater sys-

tem. Two other metals-contaminated streams in Colorado during 1996.

Ground Water Dye Tracing

In 1995, DMG applied to EPA and received a Headwaters Grant to demonstrate a dye tracer technique at the Mary Murphy Mine. The design goals of this project were:

- 1) To complete characterization of the Mary Murphy Mine discharge and ultimately quantify the remaining unknown metals source, by defining mine-groundwater metals loading pathways, and the physical fate of contaminant plumes associated with the abandoned mine workings beneath and within Chrysolite Mountain.
- 2) To demonstrate and document an innovative mine-groundwater characterization technique suitable for regional application to characterize hard-rock mine hydrologic systems in many areas of the west.

DMG contracted out drilling work and retained Cambrian Groundwater Co., a specialist consultant from Oak Ridge Tennessee, to design and assist with implementing the dye tracer study during summer 1996. Trout Unlimited's Collegiate Peaks Chapter provided volunteers

spent with a deep seated, relatively slow-flow fracture system which appears to have elevated zinc concentrations associated with flow through the upper mine workings.

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Outstanding Reclamation Efforts

By Loretta Pineda, Colorado DMG

The Colorado Mined Land Reclamation Board honored several companies for their outstanding reclamation at Colorado mines. Award presentations were made at the 100th National Western Mining conference held in Denver.

Winners of the 1996 Colorado Mined Land Reclamation Awards are:

The Colorado Lien Company for their innovative reclamation work at the Owl Canyon Quarry near Livermore in Larimer County. Using nutrient-rich sugar beet wash residue derived from sugar beet processing as a soil additive, has made a reclamation soil that is very productive and provides enhanced plant growth. The addition of the beet soil has allowed reduced fertilizer use, thus reducing problems with non-point source pollution and has significantly enhanced the revegetation of mined areas at the Owl Canyon Quarry.

The Cripple Creek and Victor Gold Mining Company is recognized for their reclamation and revegetation work at several mine waste dumps in the Cripple Creek and Victor Mining District. This award recognizes CC&V's voluntary clean-up of historic mine piles and other mine properties adjacent to their active mining operation.

The following coal mining companies were also recognized:

- Seneca II Mine - Seneca Coal Company
- Seneca II is recognized for planning and implementing several shrub estab-

lishment studies. In 1995, Seneca Coal Company established four studies to assess shrub establishment and survival. These studies were designed to pinpoint suspected shrub mortality factors and test effective remediation efforts, and to improve shrub establishment on reclaimed areas.

FINAL RECLAMATION AWARD

- The Edna Mine, Pittsburg & Midway Coal Mining Company

This nomination recognizes Edna Mine's efforts in the final reclamation of the mine. During the summer of 1996, P&M completed reclamation (backfilling, regrading, topsoil replacement, seeding, contour furrowing) of the final pit at the Moffat mining area, all facility areas, and one pond. Crews also narrowed or reclaimed all existing roads. All of the West Ridge area was seeded and contour furrowed. P&M reclaimed approximately 1,200 acres.

FINAL RECLAMATION AWARDS

- The Golden Eagle Mine, Basin Resources.

The Golden Eagle Mine officially shut down operations on December 31, 1995. During the past 12 months, the mine has gone from an operational, producing coal mine, to fully reclaimed status. All facilities have been removed, backfilling and grading has been completed, and the disturbed areas have been topsoiled, seeded and mulched.



In 1991, three tailings piles were removed, consolidated, and capped to prevent water and wind dispersion of these wastes into Chalk Creek.



Reclamation Project Completed Above Central City

By Julie Annear, Colorado Division of Minerals and Geology

The Colorado Division of Minerals and Geology, with the help of the local community and Gilpin County, has completed the first phase of a two part project near Central City. The project is funded by EPA 319 grant funds and donations from the community. The Anchor and Pozo Mill tailings project is designed to reduce erosion of metals laden mill tailings from the Anchor and Pozo Mill Sites into Willis, Russell, Nevada, and Gregory Gulches in Gilpin County. The drainages discharge to the North Fork of Clear Creek which flows to downstream water users in the Front Range. The project is also designed to disseminate information on disposal and stabilization of mill tailings, from small abandoned mining operations, and to demonstrate that, with cooperation, non-point source pollution from mines can be controlled effectively,

particularly iron and copper.

The Anchor Mill site project work was completed in October of 1996. Three on-site disposal pits were constructed to contain the tailings. The tailings were moved to the disposal pits and capped, topsoiled and revegetated. The cost of this phase of the project was roughly \$13,600.

The second phase of the project, the Pozo Project, will involve controlling drainage into Nevada and Gregory Gulches. The Pozo Mill is located near the town of Nevadaville at an elevation of approximately 9000 feet. Nevada Gulch discharges into Gregory Gulch. Both streams are intermittent with the peak flows occurring during spring runoff or storm events. The tailings are located about 50 feet from the stream and the majority of the erosion of the tailings

Mining Companies Doing More To Protect Environment ...Yet Regulatory Restrictions Cloud Future In Colorado

By Stuart Sanderson, President, Colorado Mining Association

The mining industry is doing more now than ever to protect the environment, as mining companies are "going green" with projects, throughout the state of Colorado, to protect water. Opportunities in coal, gold, molybdenum, uranium and diamonds still exist in the state, there is considerable uncertainty about mining's future, due to regulations that single out mining from other industries for special and, in many cases, more strict scrutiny.

Mining is one of the state's most viable and important industries, contributing more than \$2 billion annually to Colorado's economy. The average mine worker earns the highest wages of any industrial worker in the state, more than \$50,000 annually. Mines have also made such great strides in the area of health and safety that statistics now show that it is safer to work in a mine than in a grocery store!

Due to the increased value our society is placing on protection of the environment, more stringent rules and regulations, and a desire by mining companies to be viewed as "good neighbors," mining companies are now spending more money than ever in an effort to preserve and improve water quality. And companies are going beyond what the law requires in many cases, to remedy conditions created by historic mining activity.

Idarado and ASARCO, Inc. at the Bonanza site are producing real dividends for the environment. In many of the cases, the companies are cleaning-up disturbances they did not even create but which were left by others.

Despite these achievements, mineral producers find that they are subject to an increasing array of governmental restrictions on the conduct of their business, at the federal, state and even concerns being raised by mineral producers about their cost effectiveness. For example, the Cresson Mine in Victor, Colorado was the subject of a debate over cyanide levels in water discharging from historic mining operations in the area. (The Cresson Mine itself is a zero discharge operation and releases no pollutants). As it turns out, the Environmental Protection Agency was concerned about levels so minute that they are measured in parts per million. An independent laboratory analysis revealed that the cyanide levels in question were less than that contained in a can of lima beans.

Tom Hendricks, owner/operator of the Cross Mine near Caribou, knows firsthand the increasingly harsh impact of regulation on the small miner. He has been threatened with nearly a million dollars in fines for allegedly failing to meet discharge standards more strict than those which apply to

ry Gulches in Gilpin County. The drainages discharge to the North Fork of Clear Creek which flows to downstream water users in the Front Range. The project is also designed to disseminate information on disposal and stabilization of mill tailings, from small abandoned mining operations, and to demonstrate that, with cooperation, non-point source pollution from mines can be controlled effectively at a relatively minimal cost.

The project involves two sites: The Anchor Mill and the Pozo Mill. Phase one of the project involved reclamation of the Anchor Mill Tailings. The Anchor Mill area is located at the confluence of Willis Gulch and South Willis Gulch in the historic Russell Gulch mining district above Central City. The site is located at an elevation of 8600 feet near the headwaters of the watershed. At one time the mill tailings extended across the gulch. Over the years the tailings have been eroded by the flow in the gulch. Approximately 7,500 cubic yards of tailings remained in the flow path of Willis Gulch. Test results from a sample of tailings revealed high concentrations of heavy met-

drainage into Nevada and Gregory Gulches. The Pozo Mill is located near the town of Nevadaville at an elevation of approximately 9000 feet. Nevada Gulch discharges into Gregory Gulch. Both streams are intermittent with the peak flows occurring during spring runoff or storm events. The tailings are located about 50 feet from the stream and the majority of the erosion of the tailings also occurs during peak flow periods. Test results from a sample of the tailings revealed high concentrations of heavy metals, particularly copper and zinc, and a PH of 4.3.

The Pozo tailings will be reclaimed on site. The tailings will be consolidated, re-contoured and amended with lime, fertilizer and topsoil. The area will then be revegetated with a native seed mix. Work is expected to be completed on this project this summer.

For more information on best management practices for reclaiming mill tailings, contact Julie Annear, Colorado Division of Minerals and Geology: 303-866-3567.

environment, more stringent rules and regulations, and a desire by mining companies to be viewed as "good neighbors," mining companies are now spending more money than ever in an effort to preserve and improve water quality. And companies are going beyond what the law requires in many cases, to remedy conditions created by historic mining activity.

Here are just a few examples. In 1996, the state of Colorado and Sunnyside Gold Corporation, a subsidiary of Echo Bay Mines, entered into a precedent setting agreement by which the company agreed to spend nearly \$10 million in reclaiming abandoned mine sites that impact water quality in the upper Animas River. A similar agreement reached between Atlantic Richfield, Inc. and the state will result in millions in expenditures to clean up lands affected by Anaconda Minerals, which ARCO purchased nearly 20 years ago. Similar projects by Newmont Mining Corporation at

question were less than that contained in a can of lima beans.

Tom Hendricks, owner/operator of the Cross Mine near Caribou, knows firsthand the increasingly harsh impact of regulation on the small miner. He has been threatened with nearly a million dollars in fines for allegedly failing to meet discharge standards more strict than those which apply to the City of Boulder's drinking water.

In summary, mining companies are demonstrating their commitment to protection of water quality and the environment. For our industry to remain viable, our regulators must evaluate the cost effectiveness of increasingly strict regulations, and determine whether the rules that they set are reasonable and necessary to guard against future environmental risk.



Site has been sloped and graded prior to seeding.



Actions Completed at Placer Gulch

By Mike Baum, President MRRC

The Mining Remedial Recovery Company (MRRC) has completed reclamation in Placer Gulch in the Animas River drainage. The dump material in the Placer Creek area (lower dump area) was removed and regraded into the proposed permanent containment area. This lower dump area was cleaned to below natural ground surface based on visual observation. Sampling was then performed to confirm that the area was free of contamination.

All available topsoil and the usable cover material near the periphery of the mine dumps was removed and stored prior to movement of the dump materials. Surface drainage was diverted from the dump areas to the extent possible. These surface water diversions will remain permanent. Where feasible, the slopes were regraded to 3H:IV. Much of the area is naturally steeper than this grade, but all efforts were made to relax the slopes as much as possible.

Also the remaining mine dumps, separate from the stream area, were consolidated and regraded. The stored cover material was then used to place a one foot thick cap over the regraded dumps. Following placement of the cap, the disturbed areas were reseeded with a grass mixture recommended by South West Seed, Inc., Dolores, CO. Five test areas were developed using different applications of lime and nutrients to ascertain which mixture is most effective for establishing a growth medium. Areas not showing substantial growth were reseeded in 1996.

A shallow wetland/bog type impoundment was constructed in the area where

cently. The study indicates that a "preponderance of evidence," suggests that a major recovery of aquatic insects and fish has occurred downstream of a water treatment plant operated by Reclamation.

The Leadville Mine Drainage Tunnel, a two-mile long conduit completed during the Korean War to remove water from metal-producing mines, was determined to be a significant pollution source to the Arkansas River in the 1970's. In March of 1992, Reclamation completed construction and began operating the \$6.8 million water treatment plant designed to remove toxic heavy metals from the tunnel's discharge. Annual operating and maintenance expenses for the plant are \$850,000.

The study showed that zinc, a heavy metal toxic to aquatic life in high concentrations, was reduced 99 percent from an average of approximately 54 pounds per day to 0.3 pounds per day in the water discharged from the tunnel. Other heavy metals including cadmium and iron showed similar reductions.

The increased abundance of an aquatic mayfly species that is particularly sensitive to pollution, is "powerful evidence that this organism has recovered (downstream of the treatment plant) because of reduced metal concentrations," the study noted. Various other tests using aquatic insects confirm recovery of this section of the river.

Trout populations below the treatment plant have also increased from 534 fish per acre in 1979, and 1,865 in 1991, to 4,132 in 1994. Even though trout populations appear to be increasing, the report indicates that additional data will be necessary to confirm long-term recovery.

Toxicity downstream from the tunnel, which had ranged from 40 to 100 percent mortality on other test organisms before the treatment plant began operation, was only five percent in 1993.

Unlike many other draining mine tunnels, the potential for acid production in the Leadville Mine drainage Tunnel dis-



Highline State Park Wetland Ponds

By Carl Zimmerman

Renovation to the dam at Highline State Park near Loma which was mandated to meet dam safety requirements was viewed by partners interested in creating diverse habitat as an opportunity. The Mesa Soil Conservation District, Natural Resources Conservation Service (NRCS), Colorado State Soil Conservation Board, and a newly formed group known as the Lower Colorado River Focus Area Committee (LCRFAC) met with Chris Forman, Park Manager, last fall before construction on the dam was started. Technical talent and cooperative spirit quickly gave way to recognition of the true potential for the site. A long term plan to improve habitat below the dam was rocketed into action.

"In the course of dam excavation, we had a unique opportunity to go ahead with proposed construction of wetland ponds," remarked Chris Foreman, Highline State Park Manager. The four ponds, located below the dam near the east gate of the park, will have a water level with

ed this spring, and a wildlife viewing area will be developed later. Underground pipe and a gravity pressure drip irrigation system will furnish ample water for the plantings.

One pond location contained sand and washed gravel deposits. "When the dam is finished, the sand will be hauled to the swimming area to provide a better 'beach' experience for park visitors," said Foreman. "Construction activity has the park pretty torn up; but when spring comes the new ponds will welcome waterfowl, while the improved swim beach welcomes back swimmers."

The ponds project received a \$21,000 grant awarded to State Parks by the Mesa County Soil Conservation Board in September of this year. The Lower Colorado Wetlands Focus sought National Resource Conservation Service approval and additional funding. "The project was to be completed within six years in agreement with the grant award. However, with the unique opportunity we had," explained Foreman, "the NRCS Environ-

mixture recommended by South West Seed, Inc., Dolores, CO. Five test areas were developed using different applications of lime and nutrients to ascertain which mixture is most effective for establishing a growth medium. Areas not showing substantial growth were reseeded in 1996.

A shallow wetland/bog type impoundment was constructed in the area where the lower dump had previously been excavated. Hand planting of some natural plugs was undertaken to establish growth.

Limestone was placed in the lower portal and the channel which drains into the wetland/bog impoundment. Field tests of the limestone treated water showed a significant increase in pH values. Monitoring of the site during 1996 showed the limestone as still being effective in raising the pH. Consequently, particulants are being settled as the water passes through the impoundment structures.

Ongoing activities include continued monitoring and some maintenance activities.

Water monitoring will continue to be conducted on a yearly basis to assess the results of the remediation effort. Sampling will continue for a period of four years.

Happier Bugs & Fish In East Fork Of Arkansas

By Jeff Keidel,
Upper Arkansas Watershed

Water quality in the East Fork of the Arkansas River above Leadville has improved dramatically according to a U. S. Bureau of Reclamation report released re-

cently. The report indicates that additional data will be necessary to confirm long-term recovery.

Toxicity downstream from the tunnel, which had ranged from 40 to 100 percent mortality on other test organisms before the treatment plant began operation, was only five percent in 1993.

Unlike many other draining mine tunnels, the potential for acid production in the Leadville Mine drainage Tunnel discharge is limited. When snowmelt moves through the fractured rock and mine shafts it results in an acidic pH of 2.5 to 3.5 and picks up naturally occurring heavy metals. Before this water exits the tunnel however, it comes into contact with oxides and carbonates which results in a near neutral pH of about 6.9 in the discharge.

In 1959, Reclamation obtained the title to the tunnel from the U. S. Bureau of Mines with the intent of including the drainage water as part of the water supply for Reclamation's Fryingpan-Arkansas Project. However, it was later determined that the tunnel drainage water had previously been appropriated and Reclamation was never able to use the water for the project.

A similar water treatment plant, built and operated jointly by ASARCO and Resurrection Mining companies, removes heavy metal pollution discharged from the Yak Tunnel into California Gulch, a tributary to the Arkansas River.

Other nonpoint sources of heavy metal pollution continue to impact the water quality of the river.

For a complete copy of the report, "Improvements to the Upper Arkansas River Attributable to Operation of the Leadville Mine Drainage Tunnel Treatment Plant, "R-96-06, contact the U. S. Bureau of Reclamation at the Eastern Area Office, 11056 W. CR 18E, Loveland, CO 80537, or call (970) 667-4410.

spin quickly gave way to recognition of the true potential for the site. A long term plan to improve habitat below the dam was rocketed into action.

"In the course of dam excavation, we had a unique opportunity to go ahead with proposed construction of wetland ponds," remarked Chris Foreman, Highline State Park Manager. The four ponds, located below the dam near the east gate of the park, will benefit waterfowl with enhanced habitat. The largest of the ponds is approximately 1.5 acres.

Spillway design was modified to provide water for off-channel wetlands and plantings for wildlife. Four ponds were constructed in areas where soil was borrowed to repair the dam. A food plot along with trees and shrubs will be plant-

Agricultural Issues Forum Set For Silt, Colorado

Colorado Agriculture Commissioner Thomas A. Kourlis will conduct an Agricultural Issues Forum on March 11, 7:00 p.m. at the Silt Town Hall, Chambers room. Duane Johnson, State Conservationist for the Natural Resources Conservation Service (NRCS), has been invited to address natural resource issues and concerns.

Farmers, ranchers and all interested citizens are encouraged to take advantage of this opportunity for informal discussions of current agricultural issues and concerns in the area. Producers are welcome to bring questions and topics for discussion.

Thomas A. Kourlis said, "These agricultural forums are an excellent opportunity for me to hear directly from producers and to better respond to Colorado agriculture's needs."

The ponds project received a \$21,000 grant awarded to State Parks by the Mesa County Soil Conservation Board in September of this year. The Lower Colorado Wetlands Focus sought National Resource Conservation Service approval and additional funding. "The project was to be completed within six years in agreement with the grant award. However, with the unique opportunity we had," explained Foreman, "the NRCS Environmental Quality Improvement Project (EQIP) program approved the project and provided 70% of the funding, technical support and engineering in just two short months." Local NRCS officer Jim Currier designed the ponds and habitat enhancement.

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Sunnyside Mine Reclamation

By Larry Perino, Reclamation Manager



Before Reclamation

Each mine reclamation project is unique with its own challenges and environmental implications. Never has this been more true than the reclamation of the historic Sunnyside Mine and Mayflower Mill near Silverton. The reclamation process, now into its fifth year, involves applying Best Management Practice (BMP) technology to mitigate mining-induced impacts to the environment, historic preservation and an unprecedented agreement with the Colorado Department of Public Health and Environment (CDPHE) as well as an inventive, highly collaborative communications process involving a wide range of special interest groups working to improve the quality of water in the Upper Animas River Basin.

Sunnyside Gold Corporation, a subsidiary of Echo Bay Mines, purchased the

plan, although provision was made that concerns with the closure expressed by the Water Quality Control Division (WQCD) of CDPHE would have to be addressed since they involved discharge permits and surface water quality, which is under their jurisdiction.

WQCD's position was that if seeps and springs appeared or increased in volume as pre-mining groundwater flow paths are reestablished by removing the artificial drain created by the tunnels, these changes would be point sources, under the Clean Water Act, and require discharge permits. This position applied to all changes whether the water passed through the Sunnyside Mine or not. Sunnyside did not agree with this interpretation of the Clean Water Act and filed a suit for a judicial ruling on this issue. Without clarification or settlement of this

Colorado Center for Environmental Management (CCEM), was formed under the auspices of the Governor's office. Gov. Roy Romer was concerned about environmental restoration and hazardous waste issues arising from Department of Energy projects. CCEM was established to find collaborative means for dealing with these issues. The Upper Animas River Basin was due for a triennial stream classification review by the Water Quality Control Commission and was selected to become a test for the CCEM process after a request by WQCD for their participation.

To encourage local participation in the decision-making process and to gain ground level support for improvement of water quality in the Animas River Basin, CCEM formed the Animas River Basin Water Quality Stakeholder Working Group headquartered in Silverton. The group was open to any individual or organization interested in water quality of the Animas River basins, streams and rivers.

The goal was to create a forum where all interested parties could participate in the process aimed to improve the quality of water in the river basin.

Preserving the History of Mining

While the complete reclamation of mines and metals processing sites may seem the ultimate goal for some, for others it represents disturbance of cultural and historic resources.

Built in 1929, the Mayflower Mill was one of hundreds of precious metals processing mills in the American West. Today, only a handful remain, most in various states of ruin. The Mayflower Mill was the last major accomplishment of Charles A. Chase, a metallurgist and mining entrepreneur. With metal prices dropping, Chase sought to maximize productivity and cut operational costs by building one of the most energy efficient processing mills in the country. Gravity provided most of the energy needed to

represented the last vestiges of the areas long, colorful mining history. They were determined to somehow preserve their proud mining heritage for future generations. They realized that the Sunnyside Mine had to be closed for both economic and environmental reason, but an attempt would be made to save the Mayflower Mill.

The San Juan County Historical Society approached Bill Goodhard with the idea of preserving the mill as a historic site. As the talks continued, Goodhard, a native of Colorado's mining country, began to consider the possibility. Sunnyside's parent company, Echo Bay, gave Goodhard the go-ahead to discuss the prospect with each of the stakeholder groups and the regulating agencies.

The MLRB was one of the first to bless the idea. The Stakeholder group quickly followed. EPA through efforts of EPA's Animas River Basin Team Coordinator, Carol Russell, issued a prospective purchaser agreement. This agreement protects the society from any potential Superfund liabilities as long as the mill remains a historic site should an action be instituted in the future. With this support the transfer was finalized.

On June 15, 1996, in a special day-long celebration, the Mayflower Mill was officially granted to the San Juan County Historical Society. The donation included a fully equipped mill facility, surrounding buildings, land and the historic Animas Power and Water Company buildings and shops. The donation also included a grant from Sunnyside of \$120,000 over three years to help the Society convert the mill into a historical tour site. Last September, the 68 year old mill opened its doors to the public for the first time as a museum, honoring the memory of the men and women who made mining history. The Society is currently seeking to place the mill on the National Historic Register.

To some, the word "reclamation" has only environmental significance. But to local residents, many of whom are Silver-

orado Department of Public Health and Environment (CDPHE) as well as an inventive, highly collaborative communications process involving a wide range of special interest groups working to improve the quality of water in the Upper Animas River Basin.

Sunnyside Gold Corporation, a subsidiary of Echo Bay Mines, purchased the Sunnyside Mine and Mayflower Mill in 1985 from Standard Metals Corporation through a bankruptcy proceeding. From 1985 through 1991, Sunnyside operated the mine. In the fall of 1991, the company announced that the mine would be closed due to a lack of economically viable mineral reserve with dwindling gold values and a falling base metals market.

Sunnyside began implementation of a comprehensive reclamation plan starting in the Mayflower Mill area with pre-Sunnyside inactive tailings ponds. Reclamation plans were reviewed and modified through a technical revision process with the Mined Land Reclamation Division (MLRD) of the Colorado Department of Natural Resources. These modifications involved improving the reclamation plans to employ additional BMP technology resulting in a product more protective of water quality than originally committed to. For this work, Sunnyside received a 1994 Mined Land Reclamation Award for outstanding achievement in mining reclamation.

Placement of concrete plugs in the Sunnyside Mine access tunnels to prevent the flow of water to surface was a concept in the reclamation plan as the methodology to allow discontinuation of water treatment and final reclamation of the site facilities. Sunnyside, through engineering evaluation and design, submitted the details to implement this concept to the Mined Land Reclamation Board for approval. With stipulations for extensive monitoring and other protective measures, the Board approved the detailed

changes would be point sources, under the Clean Water Act, and require discharge permits. This position applied to all changes whether the water passed through the Sunnyside Mine or not. Sunnyside did not agree with this interpretation of the Clean Water Act and filed a suit for a judicial ruling on this issue. Without clarification or settlement of this issue, final reclamation of the Sunnyside Mine would not be possible.

Concurrent with the suit, negotiations with WQCD were held to determine if any common ground could be found to fulfill the requirements of both parties. After a lengthy negotiation process, an agreement was formulated in the form of a voluntary Consent Decree. The agreement was unprecedented in the State of Colorado, providing a mechanism for final reclamation of a discharging mine while providing adequate assurance to the State that basin water quality would be maintained with upside potential for improvement.

This voluntary Consent Decree agreement commits Sunnyside to perform multiple historic mine remediation projects throughout the basin, temporarily treat a mineralized stream and monitor water quality until equilibrium of the mine pool is reached, plus two years. This process is expected to take between 5 and 10 years. If water quality has been maintained or improved, WQCD has committed to a release of all discharge permit obligations for Sunnyside.

Sunnyside has invested more than \$12 million in reclamation at the Sunnyside and Mayflower Mill locations to date and estimates it will spend between \$3 and \$7 million more on reclamation over the next two years.

The Stakeholder Group

In April 1994, shortly after the decision was made to close the Sunnyside Mine, an environmental task force, the

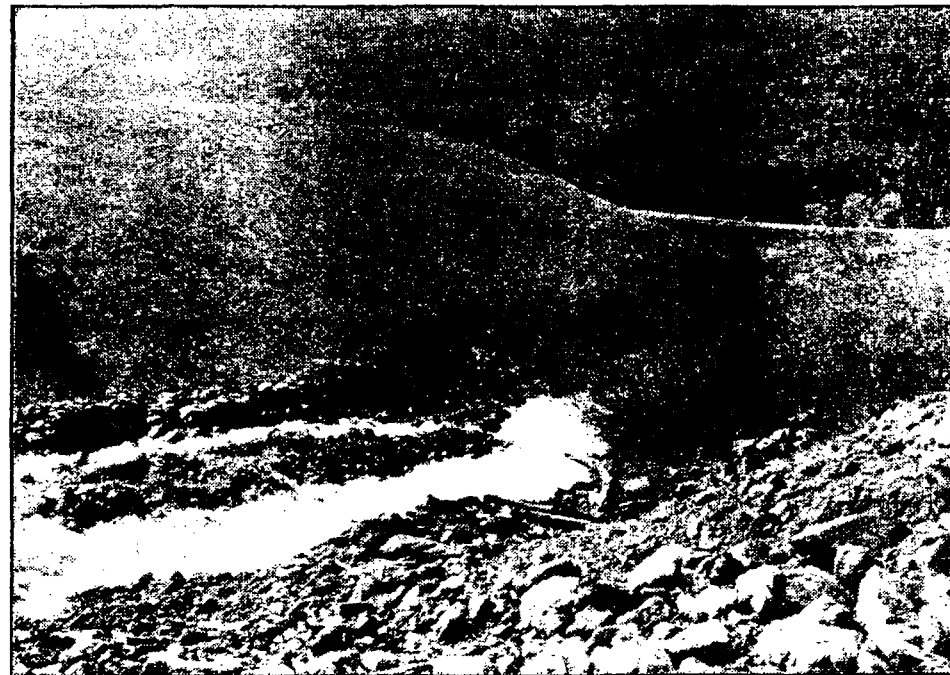
various states or ruin. The Mayflower Mill was the last major accomplishment of Charles A. Chase, a metallurgist and mining entrepreneur. With metal prices dropping, Chase sought to maximize productivity and cut operational costs by building one of the most energy efficient processing mills in the country. Gravity provided most of the energy needed to move ore from the mine to the mill and then through the various stages of the milling process.

The Mayflower was also one of the first to incorporate new environmental techniques. Chase abandoned the historical practice of dumping waste rock into the rivers, and instead, pioneered holding, or tailings ponds to contain waste material.

For the residents of Silverton, the Mayflower Mill and the Sunnyside Mine

the 88 year old mill opened its doors to the public for the first time as a museum, honoring the memory of the men and women who made mining history. The Society is currently seeking to place the mill on the National Historic Register.

To some, the word "reclamation" has only environmental significance. But to local residents, many of whom are Silverton area natives, preservation of the Mayflower Mill and Gold Prince site also meant helping the community reclaim the history and the pride of one of America's most exciting eras. To Sunnyside it has meant the balancing of social, cultural and historic concerns with regulatory agencies and environmental laws through negotiation and consensus building.



After Reclamation

Treatment Of Nonpoint Source Pollution At Abandoned/ Inactive Mines

By Dave Bucknam & Jim Herron,
Colorado Division of Minerals and
Geology (DMG)

Colorado has a considerable number of abandoned or inactive mine sites where significant water quality impacts are occurring, usually in the form of drainage from adits which is often acidic and rich in heavy metals. This acidic water forms principally through chemical reaction of surface water (rainwater, snowmelt, pond water) and shallow subsurface water with rocks that contain sulfur-bearing minerals (mainly pyrite), resulting in sulfuric acid. Heavy metals can be leached from rocks that come in contact with the acid, a process that may be substantially enhanced by bacterial action. The resulting fluids, when mixed with groundwater, surface water, and soil, may have harmful effects on humans, animals, and plants.

Mining accentuates and accelerates these natural processes. The development of underground workings, open pits, ore piles, mill tailings, and spoil heaps and the extractive processing of ores enhance the likelihood of releasing chemical elements to the surrounding area in large amounts and at increased rates relative to unmined areas.

A statewide inventory estimates that there are over 23,000 abandoned mines in Colorado. Approximately 400 draining mines are impacting or have the potential to adversely affect surface water systems. The DMG estimates that there are 615 mill sites with tailings piles in Colorado.

to abandoned or inactive mines fall into three general categories: 1) Hydrologic Control, 2) Passive Treatment, 3) Active Treatment. Very few of these can be used alone to completely address a nonpoint source problem.

Hydrologic controls

Most hydrologic controls are preventative measures in that they inhibit or prevent the process of acid formation and/or heavy metal dissolution. If it is possible to prevent water from entering a mine, or coming into contact with sulphide ores or wastes, this can be the best, most cost effective remediation approach. Unfortunately, very few cases are found where preventative measures can be effectively implemented to completely prevent mine drainage.

Diversion ditches are effective where run-on water is degraded by flowing over or through mine waste, or into mine workings. Diversion ditches can also be used to intercept shallow ground water that may become contaminated by mine waste. In some cases, mine discharge can be improved by flowing through waste rock.

Mine waste removal and consolidation is effective where there are several small mining waste piles in an area, or where there is a large pile in direct contact with flowing water. The method is simply to move reactive material away from water sources.

Stream diversion is similar to mine waste removal and consolidation. It involves moving the water sources away from reactive materials. In most cases, it is usually preferable to move mining waste rather than move the stream.

Bulkhead Seals are another type of preventative measure. For most inactive mines, bulkhead seals are expensive and require considerable geologic and engineering investigation and characterization.

Revegetation is often used in combination with other hydrologic controls. Revegetation by itself can be a very ef-

Funds Available For Wetlands

If you are considering the enhancement of a wetland area, you should develop an application for the funds available through the North American Wetlands Conservation Act. The purpose of the Act is to encourage partnerships to conserve North American wetland ecosystems for waterfowl and other migratory birds and fish and wildlife that depend upon such habitats. One application period ends April 4, 1997 and another ends on August 1, 1997. The funds may be used for land acquisition, wetland restoration and wetland creation. All funds received must be matched dollar for dollar.

For more information, contact:
Coordinator, North American
Wetlands Conservation Council
U. S. Fish and Wildlife Service
4401 North Fairfax Drive, Room 110
Arlington, VA 22203
(703) 358-1784 or fax (703) 358-2282

Final Rules For CRP

Secretary of Agriculture Dan Glickman, announced on February 12, 1997, final regulations for the USDA's Conservation Resource Program. "Under the new CRP, we will protect about 36 million acres of our most environmentally sensitive lands," Glickman said. "The days of enrolling vast amounts of productive farmland are over."

The primary goals of CRP are erosion reduction, improvement of water quality and the enhancement of wildlife habitat. There are millions of acres of cropland that could provide outstanding water quality or wildlife benefits, yet would not be eligible for enrollment based solely on



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of any CRP contracts. Producers with contracts expiring September 30, 1997 may offer their acreage for re-enrollment during the next sign-up period if the land meets the basic eligibility criteria. For additional information regarding the Conservation Reserve Program, please contact your local USDA Service Center Office.

Division Celebrates 100-Year Anniversary

On April 16, 1897, the Colorado Legislature's 11th General Assembly and

amounts and at increased rates relative to unmined areas.

A statewide inventory estimates that there are over 23,000 abandoned mines in Colorado. Approximately 400 draining mines are impacting or have the potential to adversely affect surface water systems. The DMG estimates that there are 615 mill sites with tailings piles in Colorado. The Colorado Nonpoint Source Assessment Report identified 1,283 miles of streams affected by heavy metals and acid drainage due to mining, out of 14,655 total perennial stream miles in the State. In general, heavy metals impacts occur more frequently in areas of historic mining. Impacts from abandoned or inactive mined lands present one of the major categories of current water quality problems in Colorado.

Cleanup efforts are on-going and are funded through federal, state and private funds. The Colorado Nonpoint Source Task Force develops recommendations annually on which projects should receive federal reclamation funding. To date, 16 mining-related nonpoint source remediation projects have been funded in Colorado at a cost of \$3.4 million.

In a number of site-specific instances in Colorado, private concerns are attempting to address water quality impacts from abandoned mines. Grassroots groups, such as the Clear Creek Watershed Initiative and the Animas River Watershed, comprised of private citizens, businesses, local, state and federal officials now exist. While their funding is limited, these groups can provide direction for voluntary clean-ups.

Following are some of the treatment methods used at abandoned and inactive mines.

Treatment methods

Remediation and treatment methods to address nonpoint source pollution related

Bulkhead seals are another type of preventative measure. For most inactive mines, bulkhead seals are expensive and require considerable geologic and engineering investigation and characterization.

Revegetation is often used in combination with other hydrologic controls. Revegetation by itself can be a very effective method of reducing heavy metals concentrations, particularly where much of the metals come from erosion of mining waste into a stream. Also, revegetation reduces the amount of water that infiltrates a waste pile, thereby reducing leachate production. The roots of growing plants also have been shown to produce carbonates through respiration.

Hands On Learning

The Republican River Watershed Association is hosting a Prairie Environmental Educational Workshop. This two day event will be held on June 11-12, 1997 at the Foster Group Camp, Bonny State Recreation Area, and is designed to enhance the knowledge of area teachers on the Prairie Environment.

This open air classroom will allow teachers to obtain graduate credit from Colorado State University, which can be used to update their teaching certificates. At the end of the workshop each participant will be provided with activity guides for Project Learning Tree and Project Wild, which can be used in the classroom to give students a working knowledge of the interactive systems of nature.

For more information on this workshop and to receive a workshop application contact your local Soil Conservation District or Barbara at 970-332-3173, or write Yuma County SCD at 247 N. Clay, Suite 1, Wray, Co 80758.

vast amounts of productive farmland are over."

The primary goals of CRP are erosion reduction, improvement of water quality and the enhancement of wildlife habitat. There are millions of acres of cropland that could provide outstanding water quality or wildlife benefits, yet would not be eligible for enrollment based solely on their erodibility. "We firmly believe that changes made in the final rule, which have increased the size of the pool of eligible acres, make it more possible to achieve the three primary goals of the CRP by enrolling the country's most environmentally important cropland," Glickman said.

Over the course of the CRP, Congress has directed that rental rates not exceed local market values. CRP payments will be determined based on county average dryland cash or cash rent equivalent rental rates adjusted for site-specific, soil based productivity factors. CRP payments can include an additional amount, not to exceed \$5 per acre per year, as an incentive to perform certain maintenance obligations. Cost-share assistance will be provided to establish cover on land for enrollment in the CRP.

The 1997 Agriculture Appropriations Act effectively precluded the extension

Celebrates 100-Year Anniversary

On April 16, 1897, the Colorado Legislature's 11th General Assembly and then Governor Alva Adams created the Department of Forestry, Game and Fish, making Colorado just the fourth state in the nation to establish a conservation agency as a function of its government.

One hundred years ago, Colorado residents recognized the importance of the state's wildlife resources to the quality of their lives.

As the Colorado Division of Wildlife, successor to that early department, enters its centennial year, that sentiment continues. Colorado's wildlife and the opportunities for people to enjoy it have increased as a result of the Division's management of the resource.

"As we begin our centennial year, Colorado's wildlife are both abundant and diverse," said John Mumma, the eighth director in the Division's history. "Our commitment is to manage this resource so that our children and grandchildren can continue to enjoy it."

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that's what Truax users say...**

Truax users will tell you, it's the best seed drill they've ever seen. *Nothing* matches it for precise seed placement or germination in *any kind of ground* and it's built so tough it's almost maintenance-free. Plants everything from fluffy native grasses to tiny legumes to soybeans.



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